

# EXERCISES

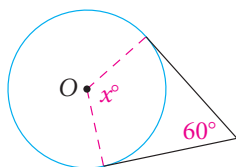
For more practice, see *Extra Practice*.

## Practice and Problem Solving

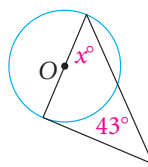
- A Practice by Example**  $x^2$  **Algebra** Assume that lines that appear to be tangent are tangent.  $O$  is the center of each circle. Find the value of  $x$ .

**Example 1**  
(page 583)

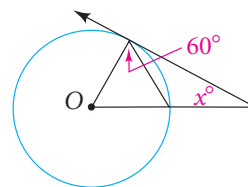
1.



2.



3.



**Examples 2, 4**  
(pages 584, 585)

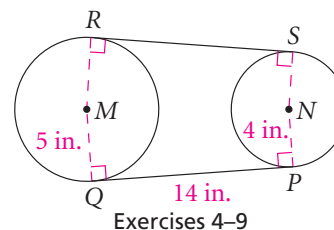


### Reading Math

$\overline{RS}$  and  $\overline{QP}$  are common tangents.

A belt fits snugly around the two circular pulleys shown.

4. Find the distance between the centers of the pulleys. Round to the nearest hundredth.
5. Give a convincing argument why the belt lengths  $RS$  and  $QP$  are equal.



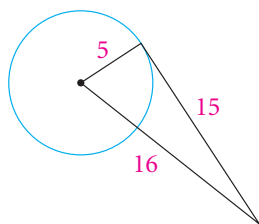
For the pulley system shown, use the lengths given below. Find the missing length to the nearest tenth.

6.  $MQ = 10$  cm,  $NP = 4$  cm,  $QP = 14$  cm,  $MN = \square$  cm
7.  $MQ = 5$  in.,  $NP = 4$  in.,  $QP = 20$  in.,  $MN = \square$  in.
8.  $MQ = 5$  in.,  $NP = 4$  in.,  $MN = 14$  in.,  $QP = \square$  in.
9.  $MQ = 10$  cm,  $NP = 4$  cm,  $MN = 14$  cm,  $RS = \square$  cm

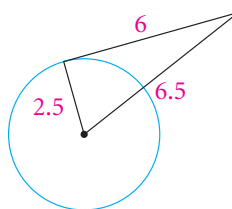
**Example 3**  
(page 584)

Determine whether a tangent line is shown in each diagram. Explain.

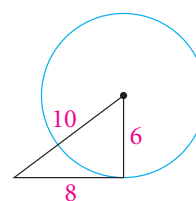
10.



11.



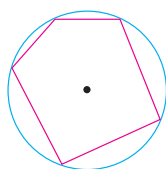
12.



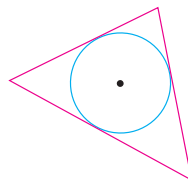
**Example 5**  
(page 585)

Tell whether each polygon is inscribed in or circumscribed about the circle.

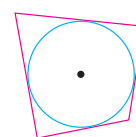
13.



14.

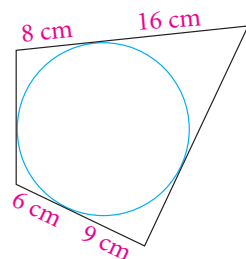


15.

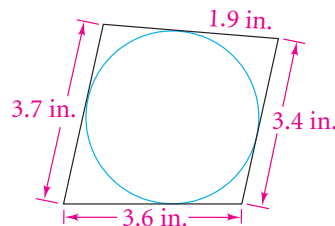


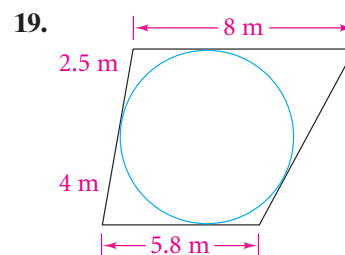
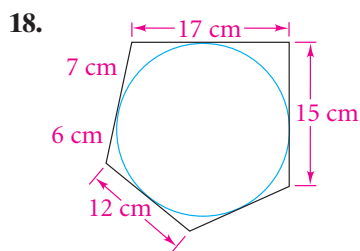
Each polygon circumscribes a circle. Find the perimeter of the polygon.

16.

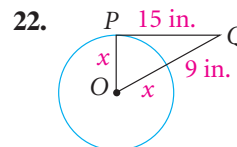
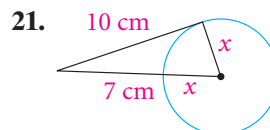
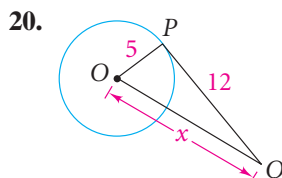


17.



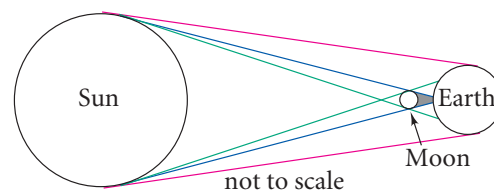


**B Apply Your Skills** **Algebra** Assume that lines that appear to be tangent are tangent.  $O$  is the center of each circle. Find the value of  $x$  to the nearest tenth.



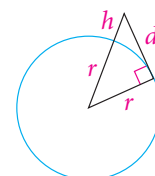
**23. Solar Eclipse** Common tangents to two circles may be *internal* or *external*. If you draw a segment joining the centers of the circles, a common internal tangent will intersect the segment. A common external tangent will not.

For this cross-sectional diagram of the sun, moon, and Earth during a solar eclipse, use the terms above to describe the types of tangents of each color.



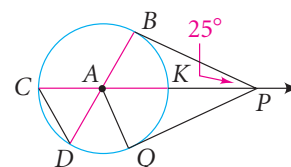
- red
- blue
- green
- Which tangents show the extent on Earth's surface of total eclipse? Of partial eclipse?
- Reasoning** In general, does every pair of circles have common tangents of both types? Explain.

**Earth** The circle at the right represents Earth. The radius of Earth is about 6400 km. Find the distance  $d$  that a person can see on a clear day from each of the following heights  $h$  above Earth. Round your answer to the nearest tenth of a kilometer.



24. 100 m      25. 500 m      26. 1 km

27.  $\overline{BD}$  and  $\overline{CK}$  at the right are diameters of  $\odot A$ .  $\overline{BP}$  and  $\overline{QP}$  are tangents to  $\odot A$ . What is  $m\angle CDA$ ?



**28. History** Leonardo da Vinci wrote, "When each of two squares touch the same circle at four points, one is double the other."

- Sketch a figure that illustrates this statement.
- Writing** Explain why the statement is true.

**29. Clocks** A regular hexagon is circumscribed about the ring surrounding the clock face. The diameter of the ring is 10 in. Find the perimeter of the hexagon.

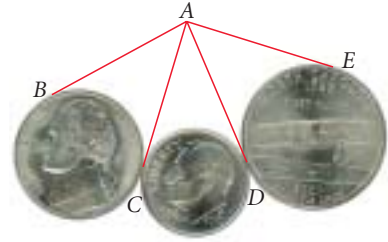
- Open-Ended** Draw a triangle circumscribed about a circle. Then draw the radius to each point of tangency.
- How many quadrilaterals are in the figure you drew in part (a)?
- Classify these special quadrilaterals. Explain.



### Need Help?

For Exercise 28(a), you must make a sketch for what da Vinci meant, not merely for what he said.

31. **Critical Thinking** A nickel, a dime, and a quarter are touching as shown. Tangents are drawn from point  $A$  to both sides of each coin. What can you conclude about the four tangent segments? Explain.

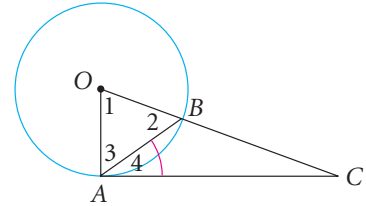


32. **Constructions** Draw a circle. Label the center  $T$ . Locate a point on the circle and label it  $R$ . Construct a tangent to  $\odot T$  at  $R$ .

$\overline{AC}$  is tangent to  $\odot O$  at  $A$ , and  $m\angle 1 = 70$ .

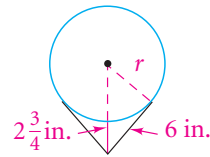
33. Find  $m\angle 4$ .

34. Let  $m\angle 1 = x$ . Find  $m\angle 4$  in terms of  $x$ .  
What is the relationship between  $\angle 1$  and  $\angle 4$ ?



35. **Coordinate Geometry** Graph the equation  $x^2 + y^2 = 9$ . Then draw a segment from  $(0, 5)$  tangent to the circle. Find the length of the segment.

36. **Maintenance** Mr. Gonzales is replacing a cylindrical air-conditioning duct. He estimates the radius of the duct by folding a ruler to form two 6-in. tangents to the duct. The tangents form an angle. Mr. Gonzales measures the angle bisector from the vertex to the duct. It is about  $2\frac{3}{4}$  in. long. What is the radius of the duct?

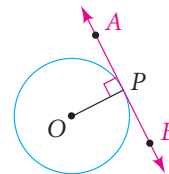


37. a. Construct two nonintersecting circles,  $\odot O$  and  $\odot P$ , of different sizes on the same sheet of paper. Neither circle should be inside the other.  
b. Carefully draw tangents from the center of  $\odot O$  to  $\odot P$ . Label the points of intersection of the tangent lines with  $\odot P$  as  $A$  and  $B$ .  
c. Carefully draw tangents from the center of  $\odot P$  to  $\odot O$ . Label the points of intersection of the tangent lines with  $\odot O$  as  $C$  and  $D$ .  
d. **Make a Conjecture** What seems to be true about  $\overline{AB}$  and  $\overline{CD}$ ? Give a convincing argument to support your conjecture. (*Hint:* Draw  $\overline{OP}$ .)

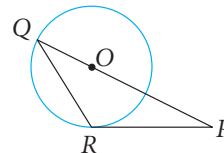
- Challenge** **Proof** 38. Write an indirect proof of Theorem 11-2.

**Given:**  $\overleftrightarrow{AB} \perp \overline{OP}$  at  $P$ .

**Prove:**  $\overleftrightarrow{AB}$  is tangent to  $\odot O$ .



39.  $\overline{PR}$  is tangent to  $\odot O$  at  $R$ ,  $OP = 17$  cm, and  $RP = 15$  cm. Find the area of  $\triangle QPR$  to the nearest tenth of a square centimeter.

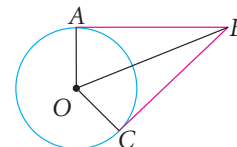


**Proof** In Exercises 40–42, write a two-column proof, paragraph proof, or flow proof.

40. Prove Theorem 11-3.

**Given:**  $\overline{BA}$  and  $\overline{BC}$  are tangent to  $\odot O$  at  $A$  and  $C$ , respectively.

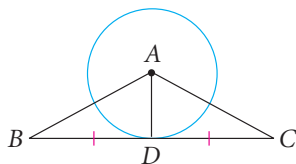
**Prove:**  $\overline{BA} \cong \overline{BC}$



41. **Given:**  $\overline{BC}$  is tangent to  $\odot A$  at  $D$ .

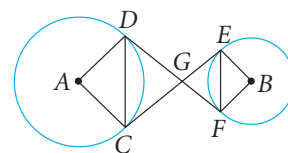
$$\overline{DB} \cong \overline{DC}$$

**Prove:**  $\overline{AB} \cong \overline{AC}$



42. **Given:**  $\odot A$  and  $\odot B$  with common tangents  $\overline{DF}$  and  $\overline{CE}$

**Prove:**  $\triangle GDC \sim \triangle GFE$

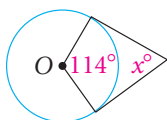


## Standardized Test Prep

### Multiple Choice

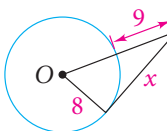
Point  $O$  is the center of each circle. Assume the lines that appear tangent are tangent. What is the value of the variable?

43.



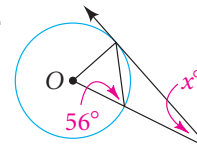
- A. 26
- B. 57
- C. 66
- D. 114

45.



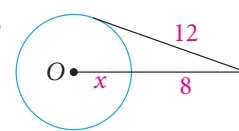
- A. 8
- B. 9
- C. 15
- D. 17

44.



- F. 22
- G. 28
- H. 34
- I. 40

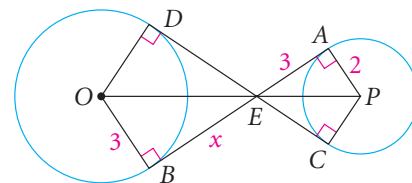
46.



- F. 2
- G. 3
- H. 4
- I. 5

### Short Response

47. Find the value of  $x$ . Show your work.



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Web Code: afa-1101

## Mixed Review

### Lesson 10-8

Two cubes have heights 6 in. and 8 in. Find each ratio.

48. similarity ratio

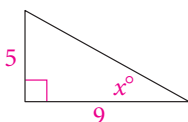
49. ratio of surface areas

50. ratio of volumes

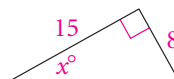
### Lesson 9-1

Find the value of  $x$ . Round answers to the nearest tenth.

51.



52.



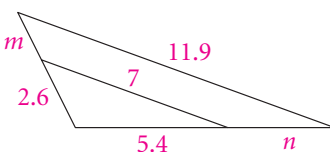
53.



### Lesson 8-2

The polygons are similar. (a) State the similarity ratio and (b) find the values of the variables.

54.



55.

